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| EXAMINER |
|---|
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| ART UNIT | PAPER NUMBER |
|---|---|
| 1765 | 3 |

DATE MAILED: 02/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/002,855 | MILLER, ANNE E. | |
| | Examiner | Art Unit | |
| | Lynette T. Umez-Eronini | 1765 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-26 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 2, 3, 4, 5, 6, and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller in view of Tsai et al. (US 5,575,706).

Feller teaches a slurry comprising a mixture of:

8.1 grams per liter of potassium citrate (~ 8.1-g/liter/306-g/mole ~ 0.03 mole/liter), (column 6, lines 3-6), which read on, between about 0.01 mole and about 0.1 mole per liter of an organic acid salt; and

an oxidant (column 4, lines 41-47), in **claim 1**.

Feller differs in failing to specify 1 and about 20 % by volume of an abrasive, **in claim 1**.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting

the composition of a slurry as taught Tsai, since it has been disclosed that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Feller further teaches 14.25 grams per liter of citric acid (~14.25g/liter/192 g/mole ~ 0.07 mole/liter) and 8.1 grams per liter of potassium citrate (~ 8.1 g/liter/306 g/mole ~ 0.03 mole/liter), (column 6, lines 3-6), which read on,

an organic salt that is a carboxylic acid salt, as in **claim 2**;

organic salt that is a citric acid salt, as in **claim 3**;

the slurry further comprising citric acid, and wherein the total amount of citric acid and citric acid salt that is included in the mixture is between about 0.01 mole and about 0.1 mole per liter of slurry, **as in claim 4**.

Feller also teaches:

a slurry between pH four and nine (column 4, lines 34-36), which reads on the slurry, wherein the mixture has a pH that is between 2.5 and about 12, **as in claim 5** and wherein the mixture has a pH that is greater than about 7.0, **as in claim 6**; and

silica is the preferred abrasive (column 5, line 6), which reads on wherein the abrasive is a silica based material, **as in claim 7**.

3. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) in view of Tsai ('706) as applied to claim 1 above, and further in view of Kaufman et al. (US 5,954,997).

Feller in view of Tsai differs in failing to teach the slurry wherein the silica-based material has a surface area that is between about 5 and 600 $m^2/g$, **in claim 8**; a corrosion inhibitor, **in claim 9**; between 0.001 mole and about 0.05 mole per liter benzotriazole, **in claim 10**; and a surfactant in **claim 11**.

Kaufman teaches a slurry that includes:

an abrasive such as silica, which would have a surface area as calculated from the Branauer, Emmet and Teller's method and which ranges from 5 $m^2/g$ to about 430$m^2/g$ and such metal oxide abrasive has been found effective in minimizing or avoiding scratching during polishing (column 7, lines 45-61);

a film forming agent, such as benzotriazole (BTA) and which may be any compound or mixtures of compounds that are capable of facilitating the formation of a passivation layer of metal oxides and the dissolution inhibiting layers on the surface of the metal layer. Passivation of the substrate surface layer is important to prevent wet etching of the substrate surface (column 4, line 44-52).

The film-forming agent is present in an amount ranging from about 0.01 weight to about 1.0 weight percent (column 5, lines 60-63), which is equivalent to:

(0.01g BTA/100 ml = 0.01g BTA/0.1 liter to (1g BTA/100 ml = 1g BTA/0.1 liter) ~

(0.01-g/119.28-g/mole)/0.1 liter BTA to (1.0-g/119.28-g/mole)/0.1 liter BTA ~

$8.3 \times 10^{-4}$ to $8.3 \times 10^{-2}$ mole/liter of BTA. Hence the above reads on, the slurry further comprising a corrosion inhibitor and the mixture includes between about 0.001 mole and about 0.05 mole per liter of benzotriazole, as claimed in the present invention.

Kaufman's slurry further includes a variety of optional additives such as surfactants that stabilize the dispersion of abrasive in the slurry against settling, flocculating, and decomposing (column 6, lines 32-37).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller in view of Tsai by employing a slurry that comprises a surface area that is between 5 and 600 $m^2/g$, a corrosion inhibitor and surfactant, as taught by Kaufman for the purpose of respectively minimizing scratching during polishing (column 7, lines 58-61), preventing wet etching of the substrate surface (column 5, lines 49-51) and promoting stabilization of a CMP slurry against settling, flocculation, and decomposition (column 6, lines 34-36).

4. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) in view of Tsai ('706) as applied to claim 1 above, and further in view of Grumbine et al. (US 6,083,419).

Feller in view of Tsai differs in failing to teach the mixture includes less than about 0.1 wt % cetyltrimethylammonium bromide.

Grumbine teaches a cmp slurry comprising corrosion inhibitors that produce alkyl ammonium ions in aqueous solutions upon dissolution, that include cetyltrimethylammonium hydroxide, tricaprylmethylammonium chloride, and tetramethylammonium hydroxide and mixture thereof (column 4, line 66 - column 5, line 26). Hence, the combination of these inhibitors in an aqueous medium inherently

produces cetyltrimethylammonium bromide, as claimed in the present invention. Grumbine further teaches the amount of inhibitor ranges from 0.001 to about 2.0 weight percent, which encompasses 0.1 wt% cetyltrimethylammonium bromide.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller in view of Tsai by using the cetyltrimethylammonium bromide as taught by Grumbine for the purpose of minimizing surface corrosion on metallic layers.

5. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) as applied to claim 1 above, and further in view of in view of Tsai ('706) and Payne (US 4,752,628).

Feller differs in failing to teach the slurry comprising a biocide, **in claim 13** and less than about 300 ppm of the biocide, **in claim 14**.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

Payne teaches a lapping composition that is made up of a biocide (column 22-24 and 30, and 51-60).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting the composition of a slurry as taught Tsai, since it has been disclosed that discovering

an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) and by using a biocide in slurry, as taught by Payne for the purpose of preparing a slurry that remains stable upon storage and shipment to the end user from a manufacturer or formulator (column 2, lines 44-46).

6. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller in view of Tsai et al. (US 5,575,706).

Feller teaches a slurry for polishing a barrier (titanium aluminide) layer (column 3, lines 32-33 and 59-51) comprising a mixture of:

8.1 grams per liter of potassium citrate (~ 8.1-g/liter/306-g/mole ~ 0.03 mole/liter), (column 6, lines 3-6), which read on, between about 0.01 mole and about 0.1 mole per liter of an organic acid salt;

an oxidant (column 4, lines 41-47), in **claim 15**.

Feller differs in failing to specify 1 and about 20 % by volume of a silica-based abrasive and between 0.0004 and about 2 moles per liter of an oxidizer, **in claim 1**.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting the composition of a slurry as taught Tsai, since it has been disclosed that discovering

an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Feller also teaches:

a slurry between pH four and nine (column 4, lines 34-36), which reads on the slurry, wherein the mixture has a pH that is greater than about 7.0, **as in claim 16**.

7. Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) in view of Tsai ('706) as applied to claim 15 above, and further in view of Kaufman et al. (US 5,954,997).

Feller in view of Tsai differs in failing to teach between 0.001 mole and about 0.05 of a corrosion inhibitor, **in claim 17**; a corrosion inhibitor that is selected from the group as recited **in claim 18**; less than 0.1 wt % of a surfactant, **in claim 19**; and a surfactant that is selected from the group as recited **in claim 20**.

Kaufman teaches a slurry that includes:

a film forming agent, such as benzotriazole (BTA) and which may be any compound or mixtures of compounds that are capable of facilitating the formation of a passivation layer of metal oxides and the dissolution inhibiting layers on the surface of the metal layer. Passivation of the substrate surface layer is important to prevent wet etching of the substrate surface (column 4, line 44-52).

The film-forming agent is present in an amount ranging from about 0.01 weight to about 1.0 weight percent (column 5, lines 60-63), which is equivalent to:

(0.01g BTA/100 ml = 0.01g BTA/0.1 liter to (1g BTA/100 ml = 1g BTA/0.1 liter) ~

(0.01-g/119.28-g/mole)/0.1 liter BTA to (1.0-g/119.28-g/mole)/0.1 liter BTA ~

$8.3 \times 10^{-4}$ to $8.3 \times 10^{-2}$ mole/liter of BTA. Hence the above reads on, the slurry further comprising a corrosion inhibitor and the mixture includes between about 0.001 mole and about 0.05 mole per liter of benzotriazole, as claimed in the present invention.

Kaufman's slurry further includes a variety of optional additives such as surfactants that stabilize the dispersion of abrasive in the slurry against settling, flocculation, and decomposition (column 6, lines 32-37) and that range from 0.001 and 2% by weight (column 6, lines 55-58), which reads on the slurry comprising less than 0.1 wt % of a surfactant, as claimed in the present invention.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller in view of Tsai by employing a slurry that comprises a corrosion inhibitor and a surfactant, as taught by Kaufman for the purpose of respectively preventing wet etching of the substrate surface (column 5, lines 49-51) and promoting stabilization of a CMP slurry against settling, flocculation, and decomposition (column 6, lines 34-36).

8. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) as applied to claim 15 above, and further in view of in view of Tsai ('706) and Payne (US 4,752,628).

Feller differs in failing to teach the slurry further comprising less than about 300 ppm of the biocide **in claim 21**.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and

planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

Payne teaches a lapping composition that is made up of a biocide (column 22-24 and 30, and 51-60).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting the composition of a slurry as taught Tsai, since it has been disclosed that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) and by using a biocide in slurry, as taught by Payne for the purpose of preparing a slurry that remain stable upon storage and shipment to the end user from a manufacturer or formulator (column 2, lines 44-46).

9. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller in view of Tsai et al. (US 5,575,706).

Feller teaches a slurry comprising a mixture of:

8.1 grams per liter of potassium citrate (~ 8.1-g/liter/306-g/mole ~ 0.03 mole/liter), (column 6, lines 3-6), which read on, between about 0.01 mole and about 0.1 mole per liter of an organic acid salt;

an oxidant (column 4, lines 41-47), **in claim 22**.

Feller differs in failing to specify 1 and about 20 % by volume of a silica-based abrasive and between 0.0004 and about 2 moles per liter of an oxidizer, and using the

slurry for polishing a barrier layer that serves to isolate a copper layer form a dielectric layer, **in claim 22**.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

Since the combination of the slurry mixture and concentration of the mixture as taught by Feller and Tsai are the same as those of the claimed invention, then it using Feller's slurry along with Tsai's adjustment of the slurry concentration would inherently read on a slurry for polishing a barrier layer that serves to isolate a copper layer from a dielectric layer as claimed in the present invention.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting the composition of a slurry as taught Tsai, since it has been disclosed that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Feller also teaches:

a slurry between pH four and nine (column 4, lines 34-36), which reads on the slurry, wherein the mixture has a pH that is greater than about 7.0, **as in claim 23**.

10. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) in view of Tsai ('706) as applied to claim 22 above, and further in view of Kaufman et al. (US 5,954,997).

Feller in view of Tsai differs in failing to teach between 0.001 mole and about 0.05 mole of a corrosion inhibitor, **in claim 24** and less than 0.1 wt % of a surfactant, **in claim 25**.

Kaufman teaches a slurry that includes:

a film forming agent, such as benzotriazole (BTA) and which may be any compound or mixtures of compounds that are capable of facilitating the formation of a passivation layer of metal oxides and the dissolution inhibiting layers on the surface of the metal layer. Passivation of the substrate surface layer is important to prevent wet etching of the substrate surface (column 4, line 44-52).

The film-forming agent is present in an amount ranging from about 0.01 weight to about 1.0 weight percent (column 5, lines 60-63), which is equivalent to:

(0.01g BTA/100 ml = 0.01g BTA/0.1 liter to (1g BTA/100 ml = 1g BTA/0.1 liter) ~

(0.01-g/119.28-g/mole)/0.1 liter BTA to (1.0-g/119.28-g/mole)/0.1 liter BTA ~

$8.3 \times 10^{-4}$ to $8.3 \times 10^{-2}$ mole/liter of BTA. Hence the above reads on, the slurry further comprising a corrosion inhibitor and the mixture includes between about 0.001 mole and about 0.05 mole per liter of benzotriazole, as claimed in the present invention.

Kaufman's slurry further includes a variety of optional additives such as surfactants that stabilize the dispersion of abrasive in the slurry against settling, flocculating, and decomposing (column 6, lines 32-37) and that range from 0.001 and

2% by weight (column 6, lines 55-58), which reads on the slurry comprising less than 0.1 wt % of a surfactant, as claimed in the present invention.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller in view of Tsai by employing a slurry that comprises a corrosion inhibitor and a surfactant, as taught by Kaufman for the purpose of respectively preventing wet etching of the substrate surface (column 5, lines 49-51) and promoting stabilization of a CMP slurry against settling, flocculating, and decomposing (column 6, lines 34-36).

11. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feller ('383) as applied to claim 22 above, and further in view of in view of Tsai ('706) and Payne (US 4,752,628).

Feller differs in failing to the slurry further comprising less than about 300 ppm of the biocide.

Tsai teaches, "Parameters which affect: the polish removal rate are . . . slurry composition . . . Adjustment of these parameters permits control of the polishing and planarization processes" (column 1, lines 61-66). Hence, Tsai provides evidence that the polishing composition is a so-called "result effective variable."

Payne teaches a lapping composition that is made up of a biocide (column 22-24 and 30, and 51-60).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Feller by adjusting

the composition of a slurry as taught Tsai, since it has been disclosed that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) and by using a biocide in slurry, as taught by Payne for the purpose of preparing a slurry that remain stable upon storage and shipment to the end user from a manufacturer or formulator (column 2, lines 44-46).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703-308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Itue
February 8, 2003

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